

# **STUDY GUIDE**

## **STABILIZATION PONDS AND AERATED LAGOONS**

### **INTRODUCTION AND ADVANCED**

#### **SUBCLASS D**

WISCONSIN DEPARTMENT OF NATURAL RESOURCES  
BUREAU OF INTEGRATED SCIENCE SERVICES  
PO BOX 7921  
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## **PREFACE**

This operator's study guide represents the results of an ambitious program. Operators of wastewater facilities, regulators, educators and local officials, jointly prepared the objectives and exam questions for this subgrade.

The objectives in this study guide have been organized into modules, and within each module they are grouped by major concepts.

## **HOW TO USE THESE OBJECTIVES WITH REFERENCES**

In preparation for the exams, you should:

1. Read all the objectives that apply to the grade level desired and write down the answers to the objectives that readily come to mind.
2. Use the references at the end of the study guide to look-up answers you don't know. This one set of references covers all of the objectives.
3. Write down the answers found in the references to those objectives you could not answer from memory.
4. Review all answered objectives until you can answer each from memory.

**IT IS ADVISABLE THAT YOU ATTEND SOME FORM OF FORMAL TRAINING IN THIS PROCESS BEFORE ATTEMPTING THE CERTIFICATION EXAM.**

## **Choosing A Test Date**

Before you choose a test date, consider the training opportunities available in your area. A listing of training opportunities and exam dates can be found in the annual DNR "Certified Operator," or by contacting your DNR Regional operator certification coordinator.



# **INTRODUCTION**

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## MODULE A: PRINCIPLE, STRUCTURE AND FUNCTION

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### **CONCEPT: PRINCIPLE OF PONDS**

1. Explain the reasons for using Ponds to treat wastewater.
2. Describe the advantages and disadvantages of pond systems compared to bio-mechanical systems for wastewater treatment.
3. Describe the following types of Ponds:
  - A. Aerobic.
  - B. Anaerobic.
  - C. Aerated.
  - D. Facultative.
4. Discuss the relationship between bacteria and algae in a Pond system.

### **CONCEPT: STRUCTURE AND FUNCTION**

5. Draw line diagrams of three Ponds in Series and in Parallel operation.
6. Explain the function of each of the following parts of a Pond system.
  - A. Dikes.
  - B. Pond seal.
  - C. Inlet and Outlet Water Control.
  - D. Flow Meter/Weirs
  - E. Headworks/Screening
  - F. Rip Rap.
7. Describe two common kinds of Pond water level control structures.
8. State two important functions of an Aeration System.

9. Describe the function of each of the following components of a Pond Aeration System:
  - A. Compressors/Blowers.
  - B. Airlines.
  - C. Diffusers.
  - D. Mechanical Aeration.
10. Describe the purpose of a Blower Air Relief Valve in a Pond Aeration System.
11. Describe what is meant by the term "freeboard" in a Pond system.

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**MODULE B: OPERATION AND MAINTENANCE**

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**CONCEPT: OPERATION**

12. Describe series and parallel modes of Pond operation, and state conditions when each should be used.
13. Discuss why some Ponds have difficulty meeting suspended solids limits.
14. Explain why an operator should prefer to have a Pond dominated by green algae.
15. List ways most Ponds gain Dissolved Oxygen.
16. Explain why dissolved oxygen concentrations vary with Pond depth.
17. List the steps to follow during start-up of a Pond system.
18. Describe strategies to use when operating a Fill and Draw Pond system.
19. Explain the conditions that indicate times to Drawdown and to Fill a Pond.

20. List the reasons why an operator would vary Pond levels.
21. Describe the proper operation of Multiple Seepage Cells.
22. Discuss how to transfer liquid from cell to cell.
23. Describe how to check for efficient aeration of a Pond.
24. Explain why pH values vary in a Pond.
25. Describe the affects of seasonal changes on Pond treatment efficiency.
26. Discuss the operating procedures for dealing with a spring thaw.

**CONCEPT: MAINTENANCE**

27. List some components of a maintenance management and recordkeeping system.
28. Describe the meaning of air gauge readings on a blower.
29. List the most common maintenance problems associated with Pond systems.
30. Discuss the maintenance of seepage cells.
31. Describe the ways to control aquatic vegetation.
32. Explain how to remove duckweed from the Pond surface.
33. Discuss how to deal with floating mats.
34. Describe how cattails are controlled without chemicals.
35. Identify types of dike vegetation, and how to control grass and other plant growths.

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**MODULE C: MONITORING AND TROUBLESHOOTING**

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**CONCEPT: MONITORING**

36. State the normal pressure reading range for the Discharge Gauge in a blower unit.
37. Describe what types of things that need monitoring usually found in the discharge permit for influent and effluent from a Pond system.
38. List ways to measure the Dissolved Oxygen level of a Pond.
39. Define where samples should be taken on a Pond to monitor the influent and effluent.
40. Describe how to take a representative sample of the contents of a Pond.
41. Explain how the following samples should be collected and preserved for analysis:
  - A. BOD.
  - B. Fecal Coliform.
  - C. Suspended Solids.
  - D. Dissolved Oxygen.
  - E. pH.
42. Discuss how to collect a representative sample from a groundwater monitoring well.

**CONCEPT: TROUBLESHOOTING**

43. List the possible causes of low water levels in a Pond.
44. List the causes and corrective actions for Seepage Cells that do not seep.
45. List some causes of Pond short-circuiting, and give corrective action for each.
46. Discuss the causes and corrective action for a Pond having a suspended solids violation while meeting BOD limits.
47. Describe what might be done if a system has unacceptable high effluent pH values.
48. Discuss the causes and corrective actions for a Pond with odor problems.

49. Describe the consequences of not controlling floating and rooted weeds in a Pond system.
50. List some burrowing animals that cause damage to dikes, and discuss control methods for each.
51. Discuss how to legally remove burrowing animals from a Pond system.

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#### MODULE D: SAFETY AND CALCULATIONS

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##### **CONCEPT: SAFETY**

52. Describe how a Pond could be judged an "Attractive Nuisance".
53. Discuss reasonable Pond security precautions against trespassing and vandalism.
54. List the personal safety precautions that should be practiced by persons operating a Pond system.
55. Discuss the risks involved while walking on the ice of a Pond to collect samples.
56. Discuss the safety precautions that should be practiced while using grass cutting equipment around a Pond.

##### **CONCEPT: CALCULATIONS**

57. Given data, calculate Pond surface area in acres.
58. Given data, calculate Pond volume in gallons.
59. Given data, calculate the volume of water discharged in gallons.
60. Given data, calculate a lagoons detention time in days.





**ADVANCED**

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**MODULE A: PRINCIPLE, STRUCTURE AND FUNCTION**

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**CONCEPT: PRINCIPLE OF PONDS**

1. Describe how the stabilization of organic waste material occurs in nature and in a wastewater treatment plant.
2. Explain photosynthesis.
3. Explain respiration.
4. Relate photosynthesis and respiration to BOD removal.
5. Relate pH, carbon dioxide, and dissolved oxygen concentrations to photosynthesis and respiration.
6. Explain why a Pond may violate pH permit limits during periods of intense photosynthesis.
7. Discuss some innovative uses of Aerated Lagoons Systems.

**CONCEPT: STRUCTURE AND FUNCTION**

8. Identify the valve action necessary to bypass a Pond cell.
9. Discuss different flow patterns that are used in Multiple Pond treatment systems.
10. Discuss the advantage of Helical Diffusers over Floating Mechanical Aerators.

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**MODULE B: OPERATION AND MAINTENANCE**

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**CONCEPT: OPERATION**

11. Explain the theory of isolation of a Pond cell which is experiencing an algae bloom in a Series Pond System.
12. Discuss the use of chemicals to control weeds.
13. Describe how Pond depth and bubble size affect aeration efficiency.
14. Explain how to balance aerators within and between Ponds.
15. Discuss when Floating Aerators are used for temporary additional aeration capacity.
16. List the important issues to consider in developing a public relations program Pond system.
17. Explain why alternate discharges to seepage cells should be practiced in a Multiple Seepage Cell System.
18. List the considerations a Pond operator would have to make when considering accepting septic tank waste.

**CONCEPT: MAINTENANCE**

19. Identify the items to be included in a Preventive Maintenance plan for a Pond system.
20. List the maintenance items on Aeration Equipment.
21. Explain how to clean clogged Air Diffusers.
22. Describe the function and maintenance of the Blower Inlet Filter.
23. Explain methods of controlling dike erosion.
24. Discuss how to prevent ice damage to floating aeration equipment.

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## MODULE C: MONITORING AND TROUBLESHOOTING

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### **CONCEPT: MONITORING**

25. Set-up a sampling schedule for a Fill and Draw Pond system.
26. Describe two ways to determine Dissolved Oxygen levels in Pond.
27. Discuss the requirements for groundwater monitoring.

### **CONCEPT: TROUBLESHOOTING**

28. Describe how to determine if a drop in a Pond water levels is caused by seepage or evaporation.
29. List the chemical and non-chemical controls for the following Pond conditions:
  - A. Algae.
  - B. Rooted Weeds.
  - C. Duckweed.
  - D. Organic Overload.
30. State the action to take if a polishing Pond produces worse suspended solids effluent than it's influent.
31. List the conditions that might lead to solids build-up on the bottom of a Pond.
32. List some possible consequences of exceeding the design organic loading rate of a Pond system.
33. Discuss the significance of long-term domination of a Pond by blue-green algae.
34. Explain why a Pond receiving a white dairy waste might turn red.

35. Describe when and how to use copper sulfate to achieve maximum control of algae.
36. List the alternatives to using Copper Sulfate for algae control.
37. Describe short circuiting and possible causes and problems it creates.

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#### **MODULE D: SAFETY AND CALCULATIONS**

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##### **CONCEPT: SAFETY**

38. List the characteristics of an affective safety program.
39. List some Pond security measures.

##### **CONCEPT: CALCULATIONS**

40. Given data, calculate pounds BOD per acre per day.
41. Given data, calculate the cost of a chemical (\$/Pound) needed to control Duckweed.
42. Given data, calculate the theoretical detention time of a Pond.
43. Given data, calculate a discharge flow rate to achieve a given Pond draw-down.
44. Given data, for a Fill and Draw Pond system, calculate the amount of draw-down required and the time required to achieve the draw-down.
45. Given data, calculate the volume of water in a groundwater monitoring well casing.

## RESOURCES

1. CONTROLLING WASTEWATER TREATMENT PROCESSES. (1984). Cortinovis, Dan. Ridgeline Press, 1136 Orchard Road, Lafayette, CA 94549.
2. GROUNDWATER SAMPLING PROCEDURES. Lindorff, David; Feld, Jodi; and, Connelly, Jack. PUBL. WR-168-87 (1987). Department of Natural Resources, Bureau of Water Resources, P.O. Box 7921, Madison, WI 53707.
3. OPERATION OF MUNICIPAL WASTEWATER TREATMENT PLANTS. Manual of Practice No.11 (MOP 11), 2nd Addition (1990), Volumes I, II, and III. Water Environment Federation (Old WPCF), 601 Wythe Street, Alexandria, VA 22314-1994. Phone (800) 666-0206. (MOP 11 1976 can still be used as a reference.)
4. OPERATION OF WASTEWATER TREATMENT PLANTS. 3rd Edition (1990), Volumes 1 and 2, Kenneth D. Kerri, California State University, 6000 J Street, Sacramento, CA 95819-6025. Phone (916) 278-6142.
5. OPERATIONS MANUAL: STABILIZATION PONDS. Zickenfoose, Charles and Hayes, R.B. EPA-430/9-77-012 (1977). U.S. Environmental Protection Agency, Office of Water Program Operation, Washington, DC 20460.
6. STABILIZATION POND OPERATION AND MAINTENANCE MANUAL. Sexauer, Willard and Karn, Roger (1979). Operator Training Unit, Minnesota Pollution Control Agency, 520 Lafayette St. Paul, MN 55155. Phone (612) 296-6300.